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SUBURBANIZATION AND URBAN PUBLIC TRANSPORT
Declining public transport in Japanese regional city and regional transport policy

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ABSTRACT

In contrast to the three major metropolitan areas of Tokyo, Osaka and Nagoya, urban transport in Japanese regional cities has been on the decline. In addition to the rise in automobile usage, the population of city centres is decreasing and that of suburbs is increasing. With these problems in mind, we examine the transport situation in Japanese regional cities, and propose a desirable urban transport policy for these cities. By using census micro-statistics, we provide a summary of the transport situation in regional cities, and compare these situations to the major metropolitan areas in the United States. We then reveal the lack of policy measures required to tackle these problems, and discuss some prospects for future urban transport policy in Japanese regional cities.

1. INTRODUCTION

In contrast to the three major metropolitan areas of Tokyo, Osaka and Nagoya, urban transport in Japanese regional cities (i.e. those with populations under 1,500,000) has been on the decline. Most such cities have a vast public bus network (operated mainly by private companies) and an underdeveloped commuter railroad network. However, public transport users, especially bus users, have been decreasing. With the increasing usage of automobiles, urban areas have expanded; and the population of city centres of regional cities is decreasing accompanied by an increase in suburban population.

Given factors such as the automobile’s convenience and comfortable housing in the suburbs, increasing automobile usage and suburbanization are allowable to some degree. However, as a result of low automobile user fees and excessive road construction in these cities, both, controlling the degree of automobile traffic and utilising public transport are important. In Japan, however, the regulatory power of regional governments concerning the public transport system is extremely weak. In most of these cities, private bus companies themselves set the service standards of public transport.

Despite the unfavourable situation, there are a few studies on transport in Japanese regional cities. Hayashi, Button and Nijikamp, eds., (1999) reported some examples of motorization in Japanese regional cities. The Japan Research Center for Transport Policy (1999; in Japanese) reported motorization in Japanese regional core cities. However, there is room for further research, especially international comparisons.

To address these problems, we examine the transport situation in Japanese regional cities, and suggest a desirable urban transport policy for these cities. In Section 2, we summarize the transport situation in regional cities using census micro-statistics. In Section 3, we compare these situations to those in the major metropolitan areas in the United States. In Section 4, we reveal the lack of policy measures required to resolve these problems. Finally, in Section 5, we discuss some prospects for future studies.

2. TRANSPORT SITUATION IN JAPANESE REGIONAL CITIES

2.1 Automobile and public transport usage: Aggregated data

Aggregated data shows that Japanese cities provide an excellent example of avoiding the usage of automobiles. For example, Table 1 illustrates the low usage of automobiles and the high usage of public transport in Japan.

Table1: Passenger transport in different nations for vehicles registered in the same vnation (2005)

	Billion passenger kilometres				Percentage of total		
	Cars	Buses	Rail	Total	Cars	Buses	Rail
Austria	70.6	9.3	9.1	89.0	79.3%	10.4%	10.2%
Belgium	108.9	17.5	9.2	135.6	80.3%	12.9%	6.8%
Denmark	52.7	7.4	5.9	66.0	79.8%	11.2%	8.9%
Finland	61.9	7.5	3.5	72.9	84.9%	10.3%	4.8%
France	727.4	43.9	76.5	847.8	85.8%	5.2%	9.0%
Germany	856.9	67.1	76.8	1,000.8	85.6%	6.7%	7.7%
Great Britain	674.0	49.0	43.2	766.2	88.0%	6.4%	5.6%
Italy	689.0	101.2	46.1	836.3	82.4%	12.1%	5.5%
Netherlands	148.8	11.8	14.7	175.3	84.9%	6.7%	8.4%
Portugal	70.0	11.0	3.8	84.8	82.5%	13.0%	4.5%
Spain	337.8	53.2	21.6	412.6	81.9%	12.9%	5.2%
Sweden	97.3	8.8	8.9	115.0	84.6%	7.7%	7.7%
Norway	53.0	4.3	2.7	60.0	88.3%	7.2%	4.5%
Switzerland	83.3	5.7	16.1	105.1	79.3%	5.4%	15.3%
Japan	751.0	86.0	385.0	1,222.0	61.5%	7.0%	31.5%
USA	7,253.5	226.8	23.1	7,503.4	96.7%	3.0%	0.3%

Source: Transport Statistics Great Britain 2006

However, public transport usage in Japan is concentrated in the large metropolitan areas. Table 2 displays the passenger km of land transport in Kanto, Kinki and other regions. This suggests that public transport, particularly rail transport, is concentrated in Tokyo and in the Kyoto-Osaka-Kobe greater metropolitan area. The percentage of rail passengers excluding Kanto (the areas around the Tokyo greater metropolitan area) and Kinki (the areas around the Kyoto-Osaka-Kobe greater metropolitan area) is 17%. This figure is roughly 40% of that of Kanto.

Japanese regional rail usage, however, is still higher than that of other countries. One reason for this is the high usage of intercity rail. The share of intercity passenger rail travel over 300 km is 42% (car 29%, aviation 26%), and intracity car usage in regional cities is expected to be higher. In the following section, we review the relevant measures of urban transport in Japanese regional cities.

Table2: Passenger transport by region in Japan

	Billion passenger kilometres				Percentage of total		
	Cars	Buses	Rail	Total	Cars	Buses	Rail
Japan(Total)	770.3	83.0	405.5	1258.8	61.2%	6.6%	32.2%
Kanto	208.6	25.3	218.2	452.1	46.1%	5.6%	48.3%
Kinki	98.4	12.8	82.9	194.1	50.7%	6.6%	42.7%
Other	463.3	45.0	104.4	612.7	75.6%	7.3%	17.0%

Kanto: Areas around Tokyo greater metropolitan area
(Tokyo, Kanagawa, Ibaraki, Tochigi, Gunma, Saitama, Chiba, Yamanashi)
Kinki: Areas around Kyoto-Osaka-Kobe greater metropolitan area
(Shiga, Kyoto, Osaka, Nara, Wakayama)
Source: Annual Statistics of Automotive Transport 2007
Statistical Survey on Railway Transport 2007
Ministry of Land, Infrastructure and Transport

2.2 Classification of Metropolitan Employment Areas (MEAs) by population

In this study, we use the Census's 'Commuting and attending school' survey, which is the only available study of commuters' and students' (15 years of age and over) residential address and their means of transport[1]. However, it is based on a complete census and is easy to compile, even for a small city. The outcome of the census consists of several forms (produced by prefectures, municipalities and small regions), and we use the census mesh blocks form. Census mesh statistics are per 1 square km rectangular block. Japan's total land area is roughly 370,000 square km, giving roughly 37,000 mesh blocks. Using mesh statistics, we can distinguish between urban and rural areas in the same municipality. It is important to confirm the degree of suburbanization in regional cities.

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[1] An origination-destination (OD) based urban transport survey ('Person Trip Survey') is the most representative statistical data for examining the urban transport situation in Japan. Since the 1960s, a 'Person Trip Survey' has been undertaken in more than 60 regional cities in Japan. However, in about one third of these cities it was not implemented for more than 20 years. The 'Nationwide Person Trip Survey' is another OD-based urban transport survey. As its name implies, it was implemented nationwide (62 cities, 4 times since 1987), but it is based on responses of only 500 households per city.

In order to use census statistical data, defining metropolitan areas is essential. In Japan, there are only 11 metropolitan areas, as defined by the government. However, other areas, for example, administrative areas such as a city or town are not suitable for establishing the situation of a regional city, because urbanisation has extended beyond the municipal boundaries, even in small cities. Therefore, we use the definition of Metropolitan Employment Areas (MEA)[2] proposed by Kanemoto, Y. and K. Tokuoka (2002).

Table 3: Distribution of population by population density d(Classified by range of population)

MEA Group (by population range)	Population (ten thousands)	Population by population density (ten thousands)					Area Total (km^2)	Area by population density(km^2)				
		Area1	Area2	Area3	Area4	Area5		Area1	Area2	Area3	Area4	Area5
(1)Population of 1,500,000 or more(9 MEAs)	6031	205	241	576	737	4272	22451	13341	1660	1960	1486	4003
		3.4%	4.0%	9.6%	12.2%	70.8%		59.4%	7.4%	8.7%	6.6%	17.8%
(2)Population of 500,000 to 1,499,999(27 MEAs)	2016	349	299	467	418	483	28269	23046	2090	1637	861	635
		17.3%	14.8%	23.2%	20.7%	24.0%		81.5%	7.4%	5.8%	3.0%	2.2%
(3)Population of 300,000 to 499,999(30 MEAs)	1176	279	191	292	259	156	27283	24161	1353	1020	525	224
		23.7%	16.2%	24.8%	22.0%	13.3%		88.6%	5.0%	3.7%	1.9%	0.8%
(4)Population of 200,000 to 299,999(18 MEAs)	442	103	69	139	94	38	12149	10951	475	474	194	55
		23.3%	15.5%	31.4%	21.2%	8.6%		90.1%	3.9%	3.9%	1.6%	0.5%
(5)Population of 199,999 or fewer(29 MEAs)	436	105	74	136	100	20	15203	13974	520	470	210	30
		24.2%	17.1%	31.2%	23.1%	4.5%		91.9%	3.4%	3.1%	1.4%	0.2%
(a) 113 MEAs total	10101	1042	873	1609	1608	4969	105355	85473	6098	5561	3275	4947
		10.3%	8.6%	15.9%	15.9%	49.2%		81.1%	5.8%	5.3%	3.1%	4.7%
(6)Other areas (city)	1132	403	238	341	133	17	47228	44027	1678	1214	283	26
		35.6%	21.0%	30.1%	11.7%	1.5%		93.2%	3.6%	2.6%	0.6%	0.1%
(7)Other areas (town & village)	1458	958	285	183	26	5	210333	207512	2062	694	57	8
		65.7%	19.5%	12.6%	1.8%	0.3%		98.7%	1.0%	0.3%	0.03%	0.00%
(b)Total	12691	2403	1396	2133	1767	4992	362916	337013	9838	7469	3615	4980
		18.9%	11.0%	16.8%	13.9%	39.3%		92.9%	2.7%	2.1%	1.0%	1.4%

Area1: Areas with low population density (population density 999 person/km^2 or less)
Area2: Areas with low population density (population density 1000–1999 person/km^2)
Area3: Areas with medium population density (population density 2000–3999 person/km^2)
Area4: Areas with medium population density (population density 4000–5999 person/km^2)
Area5: Areas with high population density (population density 6000 person/km^2 or more)

Table 3 shows the population distribution by population density in MEAs. Eighty percent of the total population of Japan lives in MEAs (Group (1–5)). In larger MEAs, the population is concentrated in densely populated areas. For example, 70.8% of the 9 MEAs whose population is 1,500,000 or more (Group (1)) inhabit areas where the density is 6000 or more. By contrast, only 4.5% of the 29 MEAs whose population is 199,999 or less (Group (5)) inhabit densely populated areas. The difference between Group (1) and Groups (2–5) is also important. MEAs in Groups (2–5), typical regional

[2] MEAs are defined as follows:
・The core is determined by the size of the Densely Inhabited District (DID) population (population not less than 50,000).
・The outlying municipalities of an MEA are defined mainly by the condition that 10% or more of employed workers commute to the core.
・The core of an MEA may contain multiple central municipalities.

cities, have relatively small densely populated areas, and the residents are inclined to live in low-density areas.

Table 4 shows commuter transport by MEA groups. As in Table 3, the share of commuters by means of transport differs between Group (1) and Groups (2–5). In MEA, 42.4% of total commuters use rail (regional railway, subway or streetcar), but only roughly 30% of Group (1) commuters use a car. However, 60–70% of the total commuter Groups (2–5) use a car, and only 6–7% use rail.

Table 4: Commuter transport by MEA Group (Classified by population range)

Commuter (to work or to school, 15 years of age and over) by Means of transport (2000).								
MEAs Group (by population range)	Percentages				Number of commuters (ten thousands)			
	Rail	Bus	Car	*Car**	Total	Rail	Bus	Car
(1)Population of 1,500,000 or more(9 MEAs)	42.4%	12.5%	28.2%	*29.8%*	3084.2	1308.5	386.8	869.4
(2)Population of 500,000 to 1,499,999(27 MEAs)	7.9%	7.0%	60.0%	*64.8%*	983.6	77.9	68.4	589.9
(3)Population of 300,000 to 499,999(30 MEAs)	7.9%	5.5%	65.1%	*70.5%*	574.6	45.4	31.6	374.0
(4)Population of 200,000 to 299,999(18 MEAs)	6.8%	4.9%	66.1%	*71.7%*	212.0	14.3	10.3	140.1
(5)Population of 199,999 or fewer(29 MEAs)	6.6%	3.0%	66.9%	*72.6%*	206.2	13.7	6.2	138.1
(a) 113 MEAs total	28.8%	9.9%	41.7%	*44.5%*	5060.7	1459.9	503.2	2111.5
(6)Other areas (city)	6.6%	2.8%	67.6%	*76.6%*	523.5	34.4	14.4	353.8
(7)Other areas (town & village)	7.8%	3.3%	70.5%	*80.1%*	625.6	48.6	20.7	441.1
(b)Total	24.8%	8.7%	46.8%	*50.5%*	6209.8	1542.9	538.4	2906.4

Car*: Parcentages except high school student

2.3 Classification of MEAs by characteristics of the region

2.3.1 Classification of MEAs by characteristics of the region: Cross section

Motorization and public transport usage exhibit many differences between regions. In most MEAs, public transport usage is low. However, some MEAs have relatively high usage of public transport. Therefore, we classify MEAs by the characteristics of the region.

Using principal component analysis and cluster analysis, we divided 83 MEAs into 7 groups (for details, refer to the Appendix). Tables 5 and 6 present a summary of each group. Groups (iii–v) of the remaining five groups are MEAs in which public transport usage is relatively high. Group (iii) consists of Naha (MEA population: approximately 740 thousand), Sasebo (320 thousand) and Nagasaki (650 thousand), and it is characterised by high bus usage, relatively low rail usage and a population that is concentrated in relatively high-density areas. This is the result of limited land, because these MEAs (Sasebo and Nagasaki) are surrounded by mountains. Naha is located on an island different from the main island of Japan, and has a low-density rail infrastructure (Naha currently has a monorail, which was inaugurated in 2003). Group (iv) has relatively high rail and bus usage, and the population is also concentrated in high-density areas. Most of the MEAs in Group (iv) are relatively isolated from any other MEA. Group (v), unlike Group (iii), has characteristics of high rail usage, relatively low rail usage [Remark 2] and the population is relatively widespread across a low-density area. These MEAs are inclined to being located along the main railway lines.

Table 5: Distribution of population by population density s(Classified by characteristics of the region)

Group	Number of MEAs	Total Population (ten thousands)	Population of each MEAs (ten thousand)			Distribution of population by population density				
			min	max	average	Area1	Area2	Area3	Area4	Area5
(i)	3	4523.1	217.3	3108.4	1507.7	2.5%	3.1%	7.7%	10.3%	76.5%
(ii)	8	1675.0	33.3	500.4	209.4	6.2%	7.0%	16.0%	18.4%	52.4%
(iii)	3	170.8	31.8	73.9	56.9	11.9%	11.4%	18.9%	18.8%	39.0%
(iv)	9	512.3	28.5	102.3	56.9	17.7%	11.7%	18.4%	18.2%	33.9%
(v)	14	722.2	21.5	96.9	51.6	14.2%	15.0%	25.2%	24.1%	21.4%
(vi)	16	743.8	22.6	87.8	46.5	21.8%	13.3%	23.9%	24.9%	16.0%
(vii)	31	1318.4	20.6	147.0	42.5	26.0%	19.3%	28.2%	18.9%	7.5%

Table 6: Commuter transport by MEA Group (Classified by characteristics of the region)

Group	Share of commuter transport								
	Rail			Bus			Car		
	Total	Area1–3	Area4–5	Total	Area1–3	Area4–5	Total	Area1–3	Area4–5
(i)	48.3%	35.3%	50.3%	12.6%	12.7%	12.6%	23.5%	44.1%	20.5%
(ii)	23.9%	20.4%	25.3%	12.3%	9.9%	13.3%	43.1%	56.8%	37.6%
(iii)	3.6%	3.2%	3.9%	18.2%	16.2%	19.6%	52.5%	61.0%	46.5%
(iv)	6.2%	7.1%	5.4%	9.9%	7.7%	11.8%	58.1%	67.0%	50.5%
(v)	12.3%	12.2%	12.4%	5.2%	4.6%	6.0%	58.3%	64.2%	51.2%
(vi)	4.4%	5.2%	3.3%	6.2%	5.0%	7.7%	65.4%	70.2%	58.8%
(vii)	7.1%	7.3%	6.8%	3.0%	2.7%	3.8%	67.2%	71.0%	57.0%

Of these, Groups (i and ii) together are Group (2) of Section 2.2 and Kitakyusyu (MEA population: 1.3 million) and Odawara (332 thousand)[3]. Group (i) includes Tokyo (MEA population: 31 million), Osaka (12 million) and Kobe (2 million). As noted in Section 2.2, public transport usage in these MEAs is high, but rail commuters in Group (ii) constitute roughly half of Group (i), and bus commuters account for only about 10% of these groups.

Groups (vi) and (vii), with a total of 47 MEAs, are MEAs where public transport usage is relatively low. Group (vi) is a group where bus commute is relatively high, and in Group (vii) rail commute is relatively high. The population is spread over a fairly low-density area, and car usage is inclined to be high in these MEAs. In particular, car usage in low-density areas in these MEAs is extremely high. As Table 5 illustrates, 70% of the total commuters in Areas 1 and 2 (areas with population density 0–3999

[3] The distribution of population and transport usage in Odawara resembles Tokyo MEA, because it is located on the edges of Tokyo MEA. Nevertheless, car usage in Odawara is higher than in Tokyo.

person/km^2) of Groups (vi) and–(vii) use a car. Most of the MEAs in Groups (vi) and –(vii) are relatively small; however, some are comparatively large[4].

2.3.2 Classification of MEAs by characteristics of the region: Over time

In addition to the existence of MEAs with low public transport usage, decline of public transport usage is another characteristic of Japanese regional cities. Even in MEAs with relatively high public transport usage, the decline has proceeded dramatically.

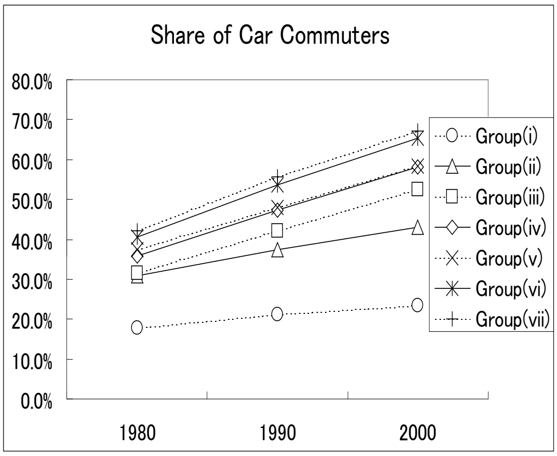

Figure 1: Share of Car Commuters

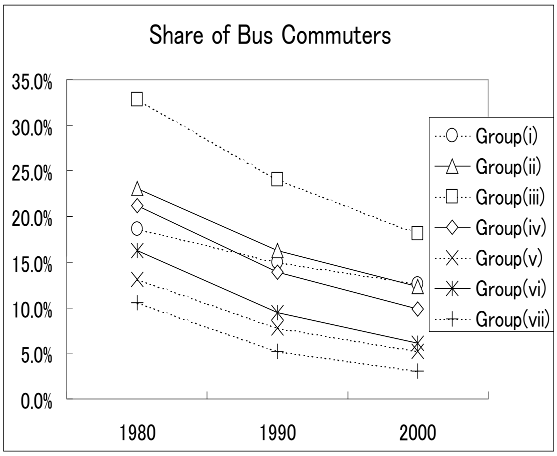

Figure 2: Share of Bus Commuters

Figures 1–3 illustrate the share of commuters and their shift over time. As these figures exhibit, the share of car commuters is increasing over time and that of bus commuters is decreasing; however, the trend differs between groups. Car commuters' share of groups (i) and (ii) has increased lesser in comparison with other groups. Bus commuters' share of group (i) has decreased lesser than that of other groups.

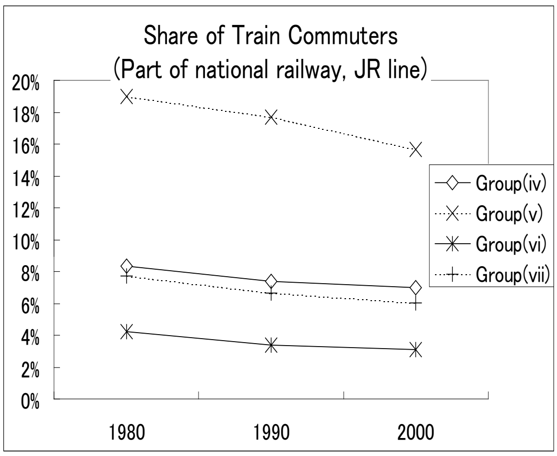

Figure 3: Share of Train Commuters

[4] Okayama (MEA population: 1.4 million) is the largest MEA in Group (vii). Though Okayama has a streetcar and regional railway system, its public transport usage is relatively small (rail 8.6%, bus 4.1%, car 61.2%).

In contrast, the extent of train commuters' share is reasonably small. Because of data limitations, we cannot clearly establish the trend of train commuters. However, the share has increased from 2% to 4% in the past 20 years. This is because the fares of the regional railways (most of them operated by JR group) have been lower and more stable than those of buses.

It is also important to note the changes in population distribution. Table 7 exhibits population distribution in 1980 and the rate of population increase from 1980 to 2000. The populations of low-density areas (Area1) are dwindling in all groups. This is because areas with a population density below 1000 persons per square km correspond to rural areas. In groups (iii–vii), the population in high-density areas is decreasing, but the population of medium-density areas (Area3–4, 2000–5999 persons per km^2) is increasing. This indicates that suburbanization is occurring in Japanese cities with the rising population of medium and reasonably low-density areas.

Table 7: Population distribution in 1980

Group	Total Population (ten thousands) 1980	Distribution of population by population density(1980)					Rate of population increase (1980→2000)					
		Area1	Area2	Area3	Area4	Area5	Total	Area1	Area2	Area3	Area4	Area5
(i)	3933.9	3.3%	3.5%	8.6%	10.3%	74.2%	15.0%	−12.9%	0.9%	2.0%	14.3%	18.5%
(ii)	1431.2	7.8%	8.1%	16.8%	15.3%	52.0%	17.0%	−7.0%	0.9%	11.1%	40.9%	18.0%
(iii)	155.6	14.4%	11.5%	18.1%	11.6%	44.4%	9.8%	−9.2%	9.1%	14.5%	78.1%	−3.5%
(iv)	469.4	20.8%	10.7%	16.3%	13.7%	38.5%	9.1%	−6.9%	19.5%	23.5%	45.1%	−3.9%
(v)	646.0	17.0%	15.5%	24.8%	18.3%	24.3%	11.8%	−6.5%	8.3%	13.5%	47.6%	−1.9%
(vi)	670.0	26.1%	12.3%	22.3%	18.0%	21.4%	11.0%	−7.1%	20.7%	19.4%	53.4%	−17.0%
(vii)	1211.7	30.8%	19.2%	22.0%	15.1%	13.0%	8.8%	−8.1%	9.6%	39.7%	36.9%	−37.1%

3. COMPARISON WITH THE UNITED STATES

In Section 2, we described the transport situation in Japanese regional cities. But how serious is it? In this section, we describe the population distribution and transport status in cities in the United States to establish the characteristics of Japanese regional cities.

Tables 8 and 9 display the population distribution by population density and transport usage in major metropolitan areas and in a sample of medium-sized metropolitan areas in 1980 and 2000. The United States Census Bureau releases demographic patterns in 'Census Tract Format'. Census tracts are small subdivisions (blocks) of a country. Unlike Census mesh statistics in Japan, a block of census tracts does not have a fixed form or size [5]. However, using this method, we can compare the geography of metropolitan areas in the United States with similar areas in Japan.

In general, metropolitan areas in the United States are characterized by a broadly spread land use pattern and low public transport usage. As Tables 7 and 8 illustrate, even in the large metropolitan areas, the population is spread over low-density areas and car usage is extremely high. In comparison with Japanese regional cities, the population is concentrated in low-density areas, and car usage in United States metropolitan areas is 10–20% higher than in Japanese regional cities. However, it is not possible to state conclusive differences between the United States and Japan. The urban population

[5] Because the blocks of census tracts become larger in low-population areas, the population in the population distribution table (Table 8) is inclined to be concentrated in low-population areas.

distribution of regional cities in Japan (Groups (iv–vii) of Table 5) is similar to that of Los Angeles PSMA (Los Angeles County, CA). This is because of the recent limited availability of land in Los Angeles County (Los Angeles County is surrounded by mountains and deserts). However, it is important to confirm that suburbanization in Japanese regional cities proceeds similar to that in a well-known motorized city. In this sample, Milwaukee PSMA (Milwaukee county and another 3 counties in WI) also have characteristics similar to Japanese suburbanized regional cities (Group (vii)).

Table 8: Distribution of population by population density: Major metropolitan areas in the United States

YEAR	SMA/PSMA	Area(km2)		Population (ten thousands)	Distribution of population by population density				
		Total	Area2–5		Area1	Area2	Area3	Area4	Area5
CENSUS 2000	Los Angeles PSMA	10591	2399	951.9	8.1%	9.3%	31.8%	22.2%	28.6%
	Chicago PSMA	13300	2193	826.6	25.7%	20.8%	20.8%	9.5%	23.3%
	Boston PSMA	13975	1116	556.5	48.8%	16.4%	13.6%	8.1%	13.1%
	Philadelphia PSMA	10105	1246	510.1	35.5%	20.5%	15.3%	8.0%	20.7%
	Detroit PSMA	10244	1491	444.2	33.3%	28.3%	32.0%	6.1%	0.3%
	Houston PSMA	15397	1317	417.0	38.4%	28.1%	29.0%	3.2%	1.3%
	Cleveland PSMA	7063	652	225.1	40.9%	25.2%	23.8%	8.4%	1.8%
	Columbus OH SMA	8208	461	154.0	47.0%	30.3%	19.2%	2.0%	1.5%
	Milwaukee WI PSMA	3868	357	150.1	43.2%	17.4%	22.6%	10.3%	6.5%
	Raleigh NC SMA	9209	186	118.8	75.8%	17.6%	4.6%	2.0%	0.0%
	Madison WI SMA	7257	106	50.2	60.5%	24.0%	9.7%	2.7%	3.2%
	Spokane WA SMA	4612	134	41.8	45.3%	33.6%	21.0%	0.0%	0.0%
CENSUS 1980	Los Angeles PSMA	10591	2194	747.4	9.6%	12.6%	43.5%	19.3%	15.1%
	Detroit PSMA	10244	1313	438.8	28.6%	19.7%	37.6%	11.6%	2.6%
	Cleveland PSMA	7063	658	227.8	34.5%	23.6%	25.5%	11.3%	5.1%
	Columbus OH SMA	8208	335	121.4	42.7%	23.9%	27.2%	4.1%	2.1%
	Milwaukee WI PSMA	3868	365	139.7	35.3%	18.3%	23.8%	13.7%	8.9%
	Spokane WA SMA	4617	123	34.2	40.7%	37.4%	21.9%	0.0%	0.0%

Italics: Sample of medium-sized metropolitan area
MSA: Metropolitan Statistical Area (defined by US Census Bureau)
PSMA: Primary Metropolitan Statistical Area
Source: Minnesota Population Center (2004)

It is also helpful to compare public transport usage between metropolitan areas of the United States and Japanese regional cities. As Table 9 illustrates, public transport usage in most US metropolitan areas is below 10%. This is lower than that in Japanese cities. (However, we must specify that the percentages of the samples of commuters in Japan include students, whereas the ones in the US do not.) However, in highly dense areas (Areas 4–5 in Table 9), the percentages are 10–25%. Public transport usage in Chicago, Boston and Philadelphia is similar to the rail and bus usage of Group (ii) in Table 6[6]. This is because these cities have an urban rapid transit system and a regional rail system. In other US cities, public transport usage in high-density areas is similar to that in other Japanese regional cities. The urban expressway networks in US cities hamper public transport usage, but there is a possibility that highly dense bus services offset this. The number of bus and other public transit services is relatively high because the US

[6] In reality, the total number of bus and rail commuters in Group (ii) is higher than in these cities, but they are nearly the same here because commuters in Japan include students and rail and bus commuters. Here, the statistics exhibit some duplication.

government is eager to provide financial assistance for public transport[7]. Further studies are required to establish the situation in detail, but these figures show some similarities between US cities and Japanese regional cities, both in spatial residential patterns and in transport usage.

Table 9: Commuter transport: Major metropolitan areas in the United States

YEAR	SMA/PSMA	Number of Commuter (ten thousands)		Share of commuter transportation					
				Public Transport			Car		
		Public Transport	Car	Total	Area1-3	Area4-5	Total	Area1-3	Area4-5
CENSUS 2000	Los Angeles PSMA	25.4	329.7	6.8%	3.2%	10.9%	88.5%	93.3%	83.3%
	Chicago PSMA	47.6	306.2	12.9%	7.4%	25.7%	82.7%	89.5%	66.9%
	Boston PSMA	26.2	226.6	9.8%	5.9%	25.0%	84.9%	90.9%	61.6%
	Philadelphia PSMA	22.5	190.6	10.0%	5.0%	26.1%	84.8%	91.8%	62.5%
	Detroit PSMA	3.7	188.0	1.9%	1.6%	8.6%	96.0%	96.5%	86.4%
	Houston PSMA	6.6	169.3	3.7%	3.4%	9.0%	93.3%	93.7%	85.0%
	Cleveland PSMA	4.2	93.9	4.2%	3.3%	14.3%	92.8%	93.9%	81.3%
	Columbus OH SMA	1.8	71.3	2.4%	2.1%	9.4%	94.4%	95.2%	75.7%
	Milwaukee WI PSMA	3.1	65.1	4.4%	2.9%	14.4%	91.9%	94.3%	77.1%
	Raleigh NC SMA	1.0	56.5	1.8%	1.7%	7.4%	94.7%	95.3%	58.3%
	Madison WI SMA	1.0	23.8	3.8%	3.4%	9.8%	88.2%	91.5%	32.4%
	Spokane WA SMA	0.5	17.0	2.9%	2.9%	–	92.9%	92.9%	–
CENSUS 1980	Los Angeles PSMA	23.3	227.7	7.0%	3.9%	13.8%	85.5%	90.5%	79.0%
	Detroit PSMA	6.4	128.6	3.7%	2.5%	14.7%	91.9%	94.3%	80.1%
	Cleveland PSMA	8.7	64.8	9.3%	7.3%	21.9%	85.0%	88.3%	72.9%
	Columbus OH SMA	2.2	34.6	4.4%	4.0%	12.9%	88.4%	91.2%	69.9%
	Milwaukee WI PSMA	4.9	39.9	8.0%	5.1%	19.8%	83.7%	89.0%	69.2%
	Spokane WA SMA	0.6	9.6	4.2%	4.3%	–	86.5%	88.7%	–

Source: Minnesota Population Center (2004)

4. PROBLEMS OF TRANSPORT POLICY IN JAPANESE REGIONAL CITIES

Both, the decline of public transport and suburbanization in regional cities are tolerable to some degree, because living in the suburbs and using an automobile provides comfort (in terms of greater housing space and door-to-door convenience). However, there are some problems such as traffic congestion. Figure 4 displays traffic congestion in Japanese regional cities (the core cities of MEAs). Because traffic congestion in large cities is more serious than in small cities, car usage (percentage of car commuters) is negatively correlated with traffic congestion. However, as Figure 4 illustrates, many regional cities have a congestion problem.

A negative contribution to global warming is another representative problem[8], but the amount of increased global warming caused by a car is lesser than the loss from traffic congestion. Global warming transforms into a serious problem if we consider the

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[7] Although the lack of coordination between public transport policy and other policy measures is a serious problem, the scale of the budget for public transport assistance is far greater than in Japan.

[8] Taniguchi and Ikeda (2005) show the relationship between population density and energy consumption by automobiles in Japanese regional cities.

increasing energy consumption of a large house or a commercial facility (large supermarket or shopping mall) in the suburbs.

To deal with traffic congestion and to reduce the environmental burden, the Japanese government has attempted to promote a public transport policy. However, there are several problems in Japanese regional transport policy. The most important of these problems is that the government's responsibility for public transport has not been explicitly established by law. The Japanese government does not have a fundamental law of transport. The 'Act on Activation and Reformation of Local Public Transport', of 2006, is intended to rejuvenate public transport in regional areas, but it does not establish either the government's responsibility or the range of government activities. The 'Road Transportation Act' and the 'Railway Business Act', the basic laws of rail and bus operation, respectively, prioritize the business activities of public transport over the precise provision of rail or bus services in regional cities. In most regional cities in Japan, a private company operates the urban bus system. These companies operate their system using their own plan. It is generally difficult for a regional government to intervene in these operating plans.

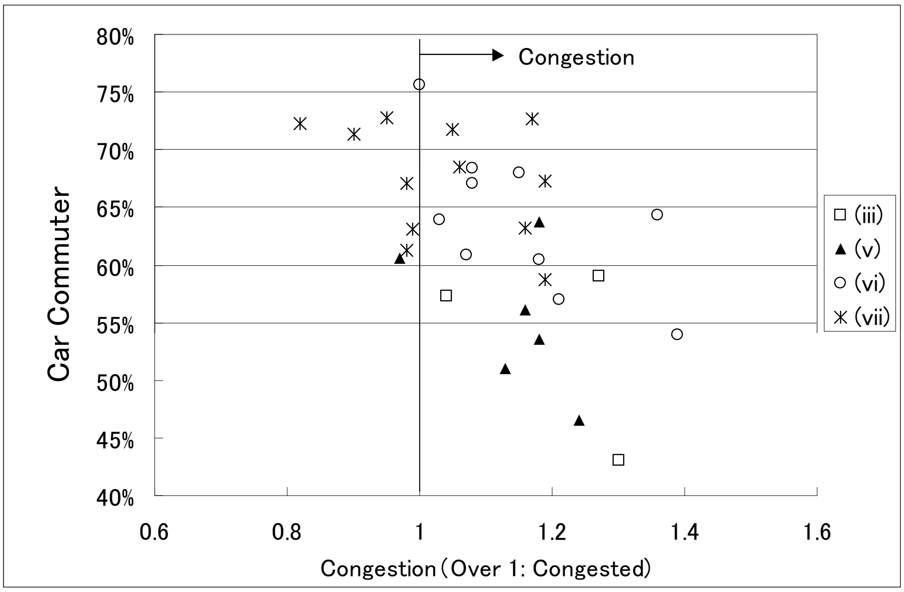

Figure 4: Traffic Congestion in Regional Cities (42 core cities from 113 MEAs)

Source: Road Traffic Census 1999
(Road Bureau, Ministry of Land, Infrastructure and Transport)

The shortage of subsidies for public transport in regional cities is the outcome of these policies. Both, the Japanese central government and regional governments offer grants for urban rail construction and for operating a bus system in rural areas. However, in regional cities there are few public subsidies[9]. The lack of subsidies leads to relatively

[9] The 'Omnibus Town Project' is one example. In this project, the central government (Ministry of Land, Infrastructure, Transport, and Tourism) selected 12 model cities, and in those cities, the central and regional governments stimulated bus priority lanes, and provided subsidies for improving bus stops and for introducing a stepless fleet. But the budget for each of these projects is only about 7–20 billion yen (about 0.7–2 million US dollars) over five years.

high fares. In regional areas, the bus fare is roughly 30–40 yen per km. This is approximately twice as much as the fare of the Japan Railways Group [10]. This is the cause of customer churn in the bus services.

Lack of coordination between transport and land usage is another problem. As shown in Section 2, suburbanization in Japanese regional cities is not extensive because of the regulation of land use. But land-usage plans in urban areas fail to consider the bus network; they only consider the rail and road networks. Combined with the difficulty of government intervention in the operations and planning of a private bus company, such lack of coordination is likely to leave the transport situation in regional cities unchanged.

5. CONCLUSION

Our analysis shows the suburbanization and declining public transport in regional cities in Japan. Automobile usage in Japan is still lower than in other developed countries, but the gap is closing, especially in regional cities. The population of suburbs is increasing, and their population distribution resembles that of Los Angeles, which is known as a motorized city. As discussed in Section 4, the policy instruments to deal with these problems are insufficient. Lack of government intervention and coordination between transport and land use promote the motorization of Japanese regional cities. In this study, however, comparisons with other countries and examination of the relationship between transport policy and land use are very limited. International comparisons of urban transport and the land use situation as well as detailed policy analysis deserve further study.

Lack of incentives and civil interest for public transport are obstacles that need to be tackled during policy formulation. In regional cities, it is difficult for public transport to be included in the policy agenda, because most inhabitants of regional cities use cars. In these cities, policy focuses on renovating roads to reduce traffic congestion, but promoting public transport for the same purpose is not regarded as popular. In other developed countries, determining government responsibility for public transport and subsidies for urban transport started when the public transport problem accelerated in large metropolitan areas. Inhabitants of such areas are interested in public transport policy. For example, the US federal government has intervened in urban public transport since 1960, because the crisis in the public transport industry in large metropolitan areas gave it an incentive to do so. Since the mid-1970s, the US federal government assistance for urban public transport has expanded into regional cities. In Japan, however, there are no financial or operating problems for the public transport industry in large metropolitan areas. This makes it difficult to provide incentives for the improvement of urban public transport policy. Thus, in a further study, a probing discussion of ways to promote public interest in public transport in regional cities, and the mechanism for the formulation of such a policy, will be important.

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[10] In most regional areas, the railways are operated by the Japan Railways (JR) Group. Because the fare rates of the JR group are nearly the same regardless of region, railway fares in regional areas are relatively low. There are also some private railways and ones operated by the Third Sector in regional cities or rural areas. Their standard fares are the same as those of the regional bus services.

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APPENDIX: PRINCIPAL COMPONENT ANALYSIS AND CLUSTER ANALYSIS OF SECTION 2.3

In this study, we use principal component analysis (PCA) and cluster analysis to classify MEA precisely. The steps of analysis are as follows.

First, we choose 84 MEAs (population over 200,000) from a total of 113 MEAs. This is because we must eliminate disturbance data and because the need for public transport in these small cities is relatively low. Then, using PCA we extract 3 principal components from MEA's 10 parameters. Each principal component is a synthetic variable of an MEA parameter. The result of PCA is shown in Table 10. Then, using cluster analysis (Parameter: 3 principal components, Method: Ward Method), we classified 83 MEAs, divided into 7 groups.

Table 10: Result of principal component analysis

Parameter			Eigenvectors		
			PC1	PC2	PC3
1	Distribution of Population	AREA1	−0.316	−0.295	−0.332
2		AREA2	−0.268	−0.108	0.220
3		AREA3	−0.069	0.526	0.683
4		AREA4	0.372	0.081	−0.085
5	Share of rail commuters	AREA1 AREA2	0.327	−0.392	0.302
6		AREA3 AREA4	0.326	−0.368	0.307
7	Share of bus commuters	AREA1 AREA2	0.330	0.327	−0.226
8		AREA3 AREA4	0.288	0.429	−0.310
9	Share of car commuters	AREA1 AREA2	−0.381	0.097	−0.128
10		AREA3 AREA4	−0.367	0.172	0.138
Eigenvalue			5.876	1.447	1.051
Contribution ratio			0.588	0.145	0.105
Cumulative contribution ratio			0.588	0.732	0.837

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